

## Claims

1. A gene detection method comprising detecting one or more gene polymorphisms selected from the group consisting of the below-described gene polymorphisms 1 through 13, to thereby detect an allergic predisposition of a subject:

1. a polymorphism of an interleukin 12 receptor  $\beta$ 2 chain gene specified by mutation of a region encoding position 313 arginine of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by the gene;

2. a polymorphism of an interleukin 12 receptor  $\beta$ 2 chain gene specified by mutation of a region encoding position 604 alanine of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by the gene;

3. a polymorphism of an interleukin 12 receptor  $\beta$ 2 chain gene specified by lack of a region encoding position 619 glycine and subsequent amino acid residues of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by the gene;

4. a polymorphism of an interleukin 12 receptor  $\beta$ 2 chain gene specified by mutation of a region encoding position 720 histidine of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by the gene;

5. a polymorphism of an interleukin 12 receptor  $\beta$ 1 chain gene specified by mutation of a region encoding position 361 arginine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by the gene;

6. a polymorphism of an interleukin 12 receptor  $\beta$ 1

chain gene specified by mutation of a region encoding position 365 methionine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by the gene;

7. a polymorphism of an interleukin 12 receptor  $\beta$ 1 chain gene specified by mutation of a region encoding position 378 glycine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by the gene;

8. a polymorphism of an interleukin 18 receptor  $\alpha$  chain gene specified by lack of position 317 alanine of an interleukin 18 receptor  $\alpha$  chain protein encoded by the gene;

9. a polymorphism of an interferon  $\gamma$  receptor 1 chain gene specified by mutation of a region encoding position 467 leucine of an interferon  $\gamma$  receptor 1 chain protein encoded by the gene;

10. a polymorphism of an interleukin 12-p40 subunit gene specified by substitution of position 3,696 guanine by another base, the guanine being in intron 1 of the gene;

11. a polymorphism of an interleukin 12-p40 subunit gene specified by substitution of position 3,757 cytosine by another base, the cytosine being in intron 1 of the gene;

12. a polymorphism of an interleukin 12-p40 subunit gene specified by substitution of position 12,359 thymine by another base, the thymine being in intron 4 of the gene; and

13. a polymorphism of an interleukin 12-p40 subunit gene specified by substitution of position 16,078 cytosine by another base, the cytosine being in intron 6 of the gene.

2. The gene detection method according to claim 1,

wherein said gene polymorphism 1, which is specified by mutation of a region encoding position 313 arginine of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by an interleukin 12 receptor  $\beta$ 2 chain gene, is specified such that the position 937 polymorphic base of the interleukin 12 receptor  $\beta$ 2 chain gene is guanine, and the position 313 polymorphic amino acid residue of the interleukin 12 receptor  $\beta$ 2 chain protein is glycine.

3. The gene detection method according to claim 1 or 2, wherein said gene polymorphism 2, which is specified by mutation of a region encoding position 604 alanine of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by an interleukin 12 receptor  $\beta$ 2 chain gene, is specified such that the position 1,811 polymorphic base of the interleukin 12 receptor  $\beta$ 2 chain gene is thymine, and the position 604 polymorphic amino acid residue of the interleukin 12 receptor  $\beta$ 2 chain protein is valine.

4. The gene detection method according to any of claims 1 through 3, wherein said gene polymorphism 3, which is specified by lack of a region encoding position 619 glycine and subsequent amino acid residues of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by an interleukin 12 receptor  $\beta$ 2 chain gene, is specified by lack of the bases at positions 1,856 to 1,946 of the interleukin 12 receptor  $\beta$ 2 chain gene.

5. The gene detection method according to any of claims 1 through 4, wherein said gene polymorphism 4, which is

specified by mutation of a region encoding position 720 histidine of an interleukin 12 receptor  $\beta$ 2 chain protein encoded by an interleukin 12 receptor  $\beta$ 2 chain gene, is specified such that the position 2,159 polymorphic base of the interleukin 12 receptor  $\beta$ 2 chain gene is guanine, and the position 720 polymorphic amino acid residue of the interleukin 12 receptor  $\beta$ 2 chain protein is arginine.

6. The gene detection method according to any of claims 1 through 5, wherein said gene polymorphism 5, which is specified by mutation of a region encoding position 361 arginine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by an interleukin 12 receptor  $\beta$ 1 chain gene, is specified such that the position 1,081 polymorphic base of the interleukin 12 receptor  $\beta$ 1 chain gene is thymine, and the position 361 polymorphic amino acid residue of the interleukin 12 receptor  $\beta$ 1 chain protein is tryptophan.

7. The gene detection method according to any of claims 1 through 6, wherein said gene polymorphism 6, which is specified by mutation of a region encoding position 365 methionine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by an interleukin 12 receptor  $\beta$ 1 chain gene, is specified such that the position 1,094 polymorphic base of the interleukin 12 receptor  $\beta$ 1 chain gene is cytosine, and the position 365 polymorphic amino acid residue of the interleukin 12 receptor  $\beta$ 1 chain protein is threonine.

8. The gene detection method according to any of claims 1 through 7, wherein said gene polymorphism 7, which is

specified by mutation of a region encoding position 378 glycine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by an interleukin 12 receptor  $\beta$ 1 chain gene, is specified such that the position 1,132 polymorphic base of the interleukin 12 receptor  $\beta$ 1 chain gene is cytosine, and the position 378 polymorphic amino acid residue of the interleukin 12 receptor  $\beta$ 1 chain protein is arginine.

9. The gene detection method according to any of claims 1 through 8, wherein said gene polymorphism 8, which is specified by lack of position 317 alanine of an interleukin 18 receptor  $\alpha$  chain protein encoded by an interleukin 18 receptor  $\alpha$  chain gene, is specified by lack of the bases at positions 950 to 952 of the interleukin 18 receptor  $\alpha$  chain gene.

10. The gene detection method according to any of claims 1 through 9, wherein said gene polymorphism 9, which is specified by mutation of a region encoding position 467 leucine of an interferon  $\gamma$  receptor 1 chain protein encoded by an interferon  $\gamma$  receptor 1 chain gene, is specified such that the position 1,400 polymorphic base of the interferon  $\gamma$  receptor 1 chain gene is cytosine, and the position 467 polymorphic amino acid residue of the interferon  $\gamma$  receptor 1 chain protein is proline.

11. The gene detection method according to any of claims 1 through 10, wherein said gene polymorphism 10 is specified such that the position 3,696 polymorphic base of the interleukin 12-p40 subunit gene, which base is in intron

1' of the gene, is adenine.

12. The gene detection method according to any of claims 1 through 11, wherein said gene polymorphism 11 is specified such that the position 3,757 polymorphic base of the interleukin 12-p40 subunit gene, which base is in intron 1 of the gene, is thymine.

13. The gene detection method according to any of claims 1 through 12, wherein said gene polymorphism 12 is specified such that the position 12,359 polymorphic base of the interleukin 12-p40 subunit gene, which base is in intron 4 of the gene, is guanine.

14. The gene detection method according to any of claims 1 through 13, wherein said gene polymorphism 13 is specified such that the position 16,078 polymorphic base of the interleukin 12-p40 subunit gene, which base is in intron 6 of the gene, is thymine.

15. The gene detection method according to any of claims 1 through 14, wherein, in the case of detection of a gene polymorphism in introns of the interleukin 12-p40 subunit gene, a polymorphism of the position 3,696 base or position 3,757 base is detected in intron 1 of the gene.

16. The gene detection method according to any of claims 1 through 15, wherein, in the case of detection of a gene polymorphism in introns of the interleukin 12-p40 subunit gene, a polymorphism of the position 12,359 base is detected in intron 4 of the gene, or a polymorphism of the position 16,078 base is detected in intron 6 of the gene.

17. The gene detection method according to any of claims 1 through 16, which employs the invader assay for detecting a gene polymorphism.

18. A gene detection kit comprising an element for detecting one or more gene polymorphisms selected from the group consisting of the below-described gene polymorphisms 1 through 13:

1. a polymorphism of an interleukin 12 receptor  $\beta 2$  chain gene specified by mutation of a region encoding position 313 arginine of an interleukin 12 receptor  $\beta 2$  chain protein encoded by the gene;

2. a polymorphism of an interleukin 12 receptor  $\beta 2$  chain gene specified by mutation of a region encoding position 604 alanine of an interleukin 12 receptor  $\beta 2$  chain protein encoded by the gene;

3. a polymorphism of an interleukin 12 receptor  $\beta 2$  chain gene specified by lack of a region encoding position 619 glycine and subsequent amino acid residues of an interleukin 12 receptor  $\beta 2$  chain protein encoded by the gene;

4. a polymorphism of an interleukin 12 receptor  $\beta 2$  chain gene specified by mutation of a region encoding position 720 histidine of an interleukin 12 receptor  $\beta 2$  chain protein encoded by the gene;

5. a polymorphism of an interleukin 12 receptor  $\beta 1$  chain gene specified by mutation of a region encoding position 361 arginine of an interleukin 12 receptor  $\beta 1$  chain protein encoded by the gene;

6. a polymorphism of an interleukin 12 receptor  $\beta$ 1 chain gene specified by mutation of a region encoding position 365 methionine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by the gene;

7. a polymorphism of an interleukin 12 receptor  $\beta$ 1 chain gene specified by mutation of a region encoding position 378 glycine of an interleukin 12 receptor  $\beta$ 1 chain protein encoded by the gene;

8. a polymorphism of an interleukin 18 receptor  $\alpha$  chain gene specified by lack of position 317 alanine of an interleukin 18 receptor  $\alpha$  chain protein encoded by the gene;

9. a polymorphism of an interferon  $\gamma$  receptor 1 chain gene specified by mutation of a region encoding position 467 leucine of an interferon  $\gamma$  receptor 1 chain protein encoded by the gene;

10. a polymorphism of an interleukin 12·p40 subunit gene specified by substitution of position 3,696 guanine by another base, the guanine being in intron 1 of the gene;

11. a polymorphism of an interleukin 12·p40 subunit gene specified by substitution of position 3,757 cytosine by another base, the cytosine being in intron 1 of the gene;

12. a polymorphism of an interleukin 12·p40 subunit gene specified by substitution of position 12,359 thymine by another base, the thymine being in intron 4 of the gene; and

13. a polymorphism of an interleukin 12·p40 subunit gene specified by substitution of position 16,078 cytosine by another base, the cytosine being in intron 6 of the gene.



19. The gene detection kit according to claim 18, which employs the Invader assay for detecting a gene polymorphism.